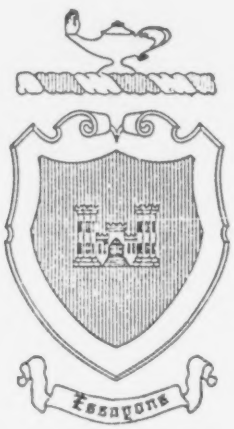
1/2

STUDENT WORKBOOK

MOBILE ELECTRIC POWER
350 AMPERE WELDING MACHINE

52D20 234-D-1022

POWER GENERATION EQUIPMENT REPAIRER COURSE



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NAME_____ CLASS NUMBER_____

WELDING MACHINE

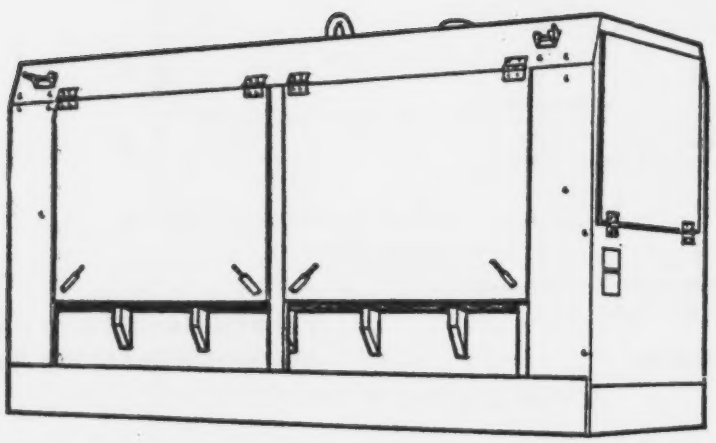
NOTE: In order to prepare for this lesson, use the home study questions in rear of this workbook using supplemental training material. You will be graded on "Class Participation" in the following areas during your instructional periods.

1. Circuit Tracing in the Classroom
2. Circuit Testing in the Laboratory
3. Homework Study Assignments

Failure to satisfactory complete all, or a combination of the above will result in the loss of two points on your performance exam. You must bring this workbook to each scheduled class and use the lesson outline portion for notes and as a guide for practical exercises.

WELDING MACHINE DCC 353-P

350 AMP DIESEL DRIVEN ARC WELDER



INTRODUCTION TO THE DCC 353-P WELDER

The DCC 353-P Welder is a four cylinder Perkins Diesel Engine Driven Welding Machine containing a 3Ø AC main generator rectified to DC by power diodes. It is capable of supplying 350 AMP/40 Volts in ths constant current (CC) and 350 AMPS/34 Volts in athe constant voltage modes (CV). It also consists of a 3.2KW 115V 1 Phase auxiliary AC generator to supply power for electrical operated tools and accessories. Also included, is a side mounted, rotary vane type air compressor capable of supplying 107 PSI continuously for use in carbon are gouging as well as portable pneumatic tools, included with the welding shop trailer.

This welding machine produces two types of outputs for welding applications.

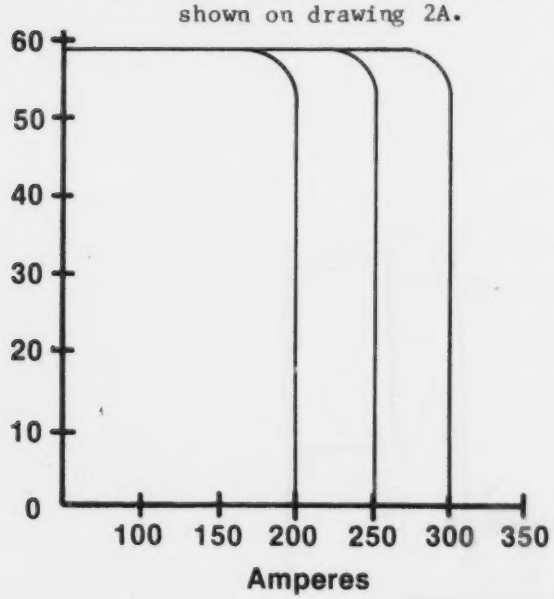
1. Constant Current (CC)

   a. Carbon Arc Gouging/Cutting

   b. Shielded Metal Arc Welding (Stick)

   c. Gas Tungsten Arc Welding (TIG)

      (1) True Constant Current produces a volt/amp curve to that shown on drawing 2A.



CONSTANT CURRENT OUTPUT

Voltage Can Rise or Fall, But Curre Remains Almost the Same

Drawing 2A

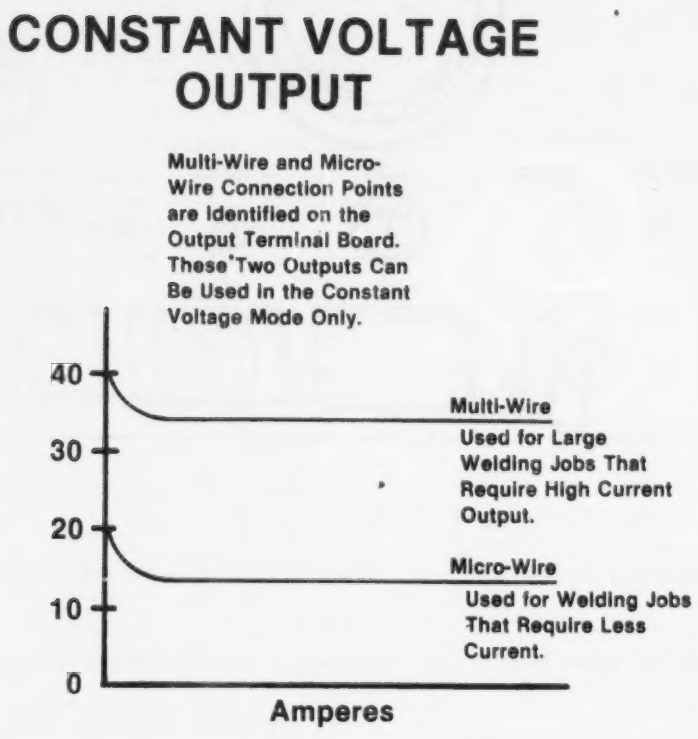
pages tightly bound

2. Constant Voltage (CV)

   a. Gas Metal Arc Welding (MIG)

   b. Flux Core Arc Welding

      (1) True Constant Voltage produces a volt/amp curve to that shown on drawing 2B.


CONSTANT VOLTAGE OUTPUT
Multi-Wire and Micro-Wire Connection Points are identified on the Output Terminal Board. These Two Outputs Can Be Used in the Constant Voltage Mode Only.
40
30
20
10
0
Multi-Wire
Used for Large Welding Jobs That Require High Current Output.
Micro-Wire
Used for Welding Jobs That Require Less Current.
Amperes
Current Can Rise or Fall But Voltage Will Remain Almost the Same

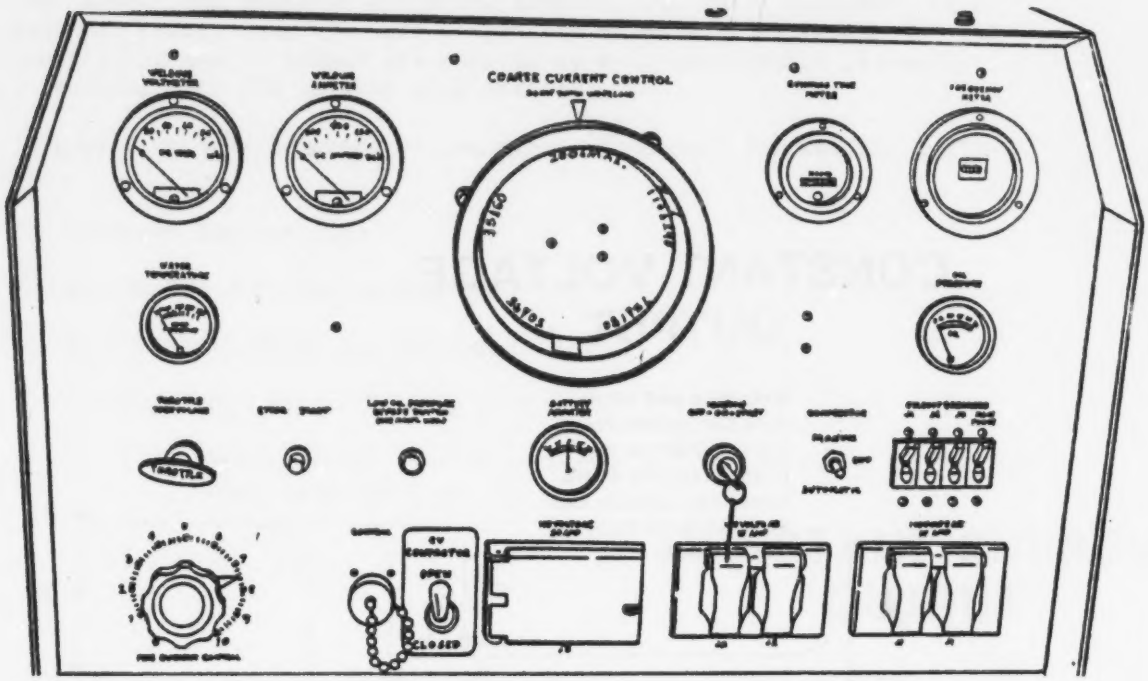
Drawing 2B

LESSON OUTLINE

FIRST HOUR

COMPONENT IDENTIFICATION OF THE 350 AMP ARC WELDER

1. Locate controls and instruments.



a. Control Panel (From Right to Left)

(1) Frequency Meter

(2) Running Time Meter

(3) Coarse Current Control

(4) Welding Ammeter

(5) Welding Voltmeter

READEX FICHE best copy available

(6) Oil Pressure Gauge

(7) Water Temperature

(8) Circuit Breakers

(9) Air Compressor Mode Switch

(10) Keylock Switch

(11) Battery Charging Ammeter

(12) Low Oil Pressure By-Pass Switch

(13) Ether Start

(14) Throttle

(15) Auxiliary Power Outlets

(16) CV Contactor Switch

(17) Control Receptacle

(18) Fine Current Control

b. Locate components right side of welder.

(1) Control Reactor (L1)

(2) Power Rectifier (CR1)

(3) Contactor Assembly (K1)

a. K1-1 Contacts

b. K1-2 Contacts

c. Locate components left side of welder.

(1) Ballast Resistor Box (R5, R6, R7)

(2) Stabilizing Reactor (L2)

(3) Reed Switch (S-5)

(4) Selector Switch (S-2)

5. Welding Set Contactor Receptacle (Output)

a. Positive CC Terminal

b. Positive CV Multi-Wire

c. Positive CV Micro-Wire

d. Negative CC/CV Terminal

6. Remote/Local Control Receptacle

7. Micro Switches S3 & S4

d. Locate component rear of control panel.

(1) Control Box Assembly

(2) Variable Resistors (R1 & R2) R-2 closest to control panel.

(3) Generator Field Flashing System (GFF)

(4) Bridge Rectifier (CR2)

e. Locate main components of the welder.

(1) Auxiliary Generator (L-4)

(2) Purpose:

a. Voltage 115V

b. Amperes 26A

c. Frequency 60Hz

d. Phase

e. Excites the revolving fields of the welding generator through the control box and control rectifier (CR2)

(3) Construction

a. Sliprings

b. Brushes

c. Revolving Fields (L-3)

f. Welding Generator (L-6)

(1) Purpose:

(a) CC maximum open circuit volts - 95 VDC

(b) CC minimum open circuit volts - 57 VDC

(c) CC maximum closed circuit volts - 40 VDC 350 A

(d) CV maximum open circuit volts - 51 VDC

(e) CV maximum closed circuit volts multi wire:

25 VDC 350 AMP Micro wire - 25 VDC 200 AMPS

SECOND HOUR

1. Perform Pre-Operational Checks
2. Starting Procedures (Electrical)
3. Applying Load
4. Perform Stopping Procedures (Discuss)
5. Instructor's Performance (Demo)
6. Students Performance (Student Operates Set)
7. After Operational Checks

THIRD, FOURTH, FIFTH AND SIXTH HOURS

1. Engine Electrical Components and Circuits

   Battery - (12 VDC 2 ea Connected in Parallel)

   Starter

   Starter Solenoid

   Ether Start Push Button Switch

   Alternator

   Battery Charging Ammeter

   Keylock Ignition Switch

   Low Oil Pressure Bypass Pushbutton Switch

   High Temperature Switch

   Oil Pressure Swith

   Overspeed Switch

   Running Time Meter

   Shutdown Solenoid

2. Engine Circuit Analysis

a. Engine Crank Circuit: Common ground of starter solenoid, (S) terminal of keylock switch, battery charging ammeter, to positive side of battery simultaneously closing starter solenoid contacts and completing the circuit to the starter, causing it to crank. (See Drawing 2C)

b. Engine Start Circuit: Common ground of shutdown solenoid, fuse, low oil pressure by-pass pushbutton to keylock switch (I), battery charging ammeter, to the positive side of the battery (See Drawing 2D).

c. Generator Field Flashing Circuit: Common ground of convenience receptacle (J2) to control box #4. (Refer to control box schematic) from Pin #4 of control box to AC2 of voltage regulator, through diode to negative of regulator, to Pin #1 of control box. (Refer to Generator Schematic) from Pin #1 of control box to negative slipring, through L3 coil to positive slipring, back to control box Pin #2. (Refer to control box schematic) from Pin #2 to term. #2 of regulator through normally closed contacts to term. #5 of control box to GFF and fuse to physical connection, to keylock switch term. (S) through the swtich to (B) to bat ammeter, and back to positive side of battery completing the circuit thus flashing the exciter revolving field (L3). (See Drawing 2E)

d. Run Circuit: From ground of shutdown solenoid fuse to overspeed switch to the now closed contacts of the oil pressure switch (18-22 PSI) to the NC contacts of high temp. switch to the run term of keylock switch, and through switch to bat ammeter to + side of battery completing the circuit allowing the engine to remain running. (See Drawing 2F)

3. Circuit Analysis of the AC Generator and DC Control Circuits

a. Auxiliary AC Circuit: (Half cycle of the AC) Begin at exciter stator (L4) in opposite direction of the current flow in (L3). AT T2 and T4. From T2 + 4 to RV1, frequency meter, and to CB4. CB4 is open so you must take the parallel path to the control box to Pin #3. (See Control Box Schematic). From Pin #3 of control box, through the 10 amp fuse to terminal #3 of regulator, through T1 transformer and out terminal #4 of regulator to Pin #4 of control box. Follow the wire down and left to a physical connection. You must complete the circuit back to L4 prior to CR2, so you will go down to common side of J1, J2, & J3, to the opposite side of the frequency meter, RV1, T3, T1 of L-4. AC is now being produced, so now pick up your parallel paths to CR2, S9 switch and J4 receptacle.

b. DC Control Circuit: Begin at the negative side of CR2 to the negative slipring and through L-S to the physical connection of R9 and to the S7 switch. From the S7 switch to the next physical connection where there is parallel path in the constant current mode only passing through R3, R2 and R1 back to the other side of the S7 switch through it and returning to the positive side of CR2 completing the circuit.

4. Circuit Analysis of the Welder Output Circuits

a. Constant Current Output Circuit:

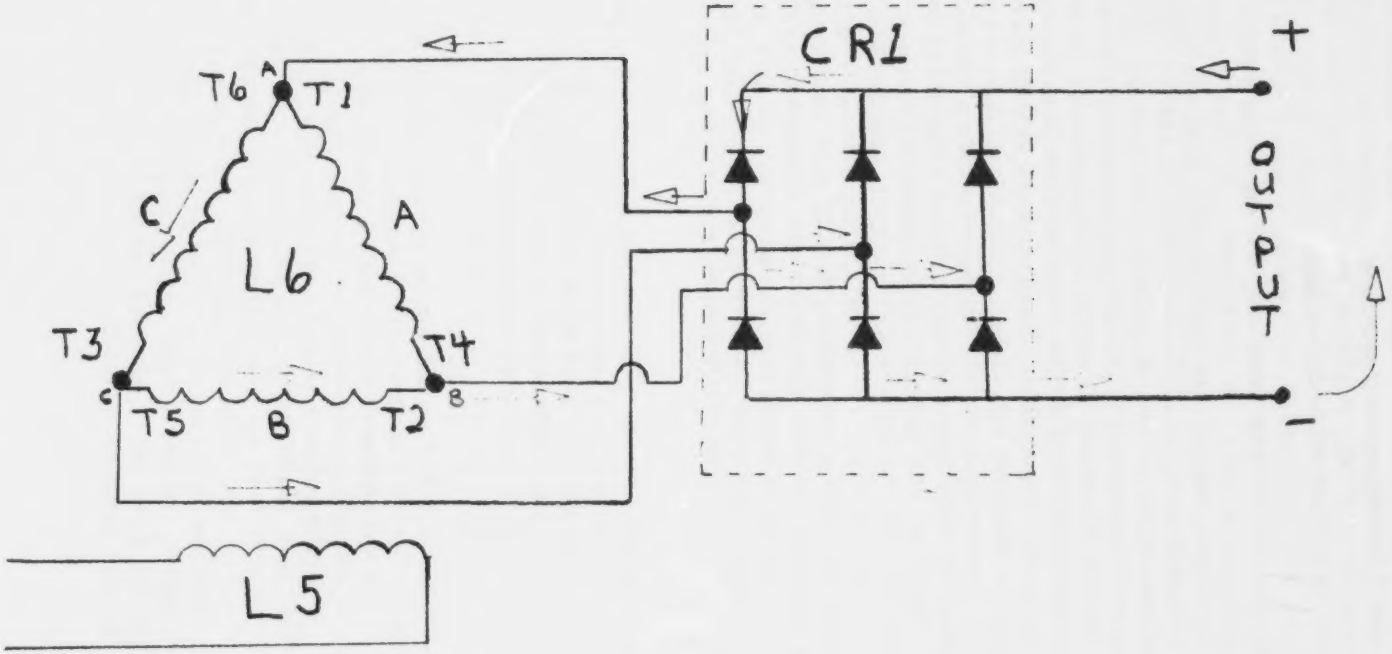
NOTE: In the Constant Current Mode, the coarse current range switch (S1) has five detented positions. Position #1 - 35-60 Amp, Position #2 - 50-95, Position #3 - 75-180, Position #4 - •110-290, Position #5 - 200 - Max.

Begin at negative CC welding terminal, through the load & L2, to the physical connection of CR1. At this point, we have a parallel path for current to flow. Select the left diode, pass through the diode to physical connection of T1. Pass through T1 and T4 coil of the wye connected generator to the S2 switch. The switch is in a constant current mode. At this point a connection is made to control reactor (L1). Pass through terminal #1 of L1 to Position #1 on the range switch (S1). The range switch has a connection between the terminals and also an internal connection. Pass through the S1 switch back out to the control reactor L1, through the S2 switch, T5 and T2 coil to the physical connection of CR1 through the shunt R8 to the negative CC/CV terminal. At this point we still have a parallel path at CR1 to complete. Begin at the middle diodes physical connection to T3 & T6 through the S2 switch through control reactor (L1) to range switch (S1). From connector of S1 switch to control reactor, back to S2 switch, to the stator windings T5 & T2 and back to the negative CC/CV welding terminal. This completes the circuit in the constant current mode in the low amperage range setting. Only a proportion of the control reactor is used in each range selection for the desired amperage. Also you have two coil groups for current and a return for continuous output.

NOTE: In the constant voltage mode the selector switch (S2) connects the stator windings in a delta configuration giving high voltage and low current output desirable for MIG welding. The output terminals have two connections. The CV multi-wire for current ranges from 20-400 amps and CV micro-wire for current ranges from 20-280 amps.

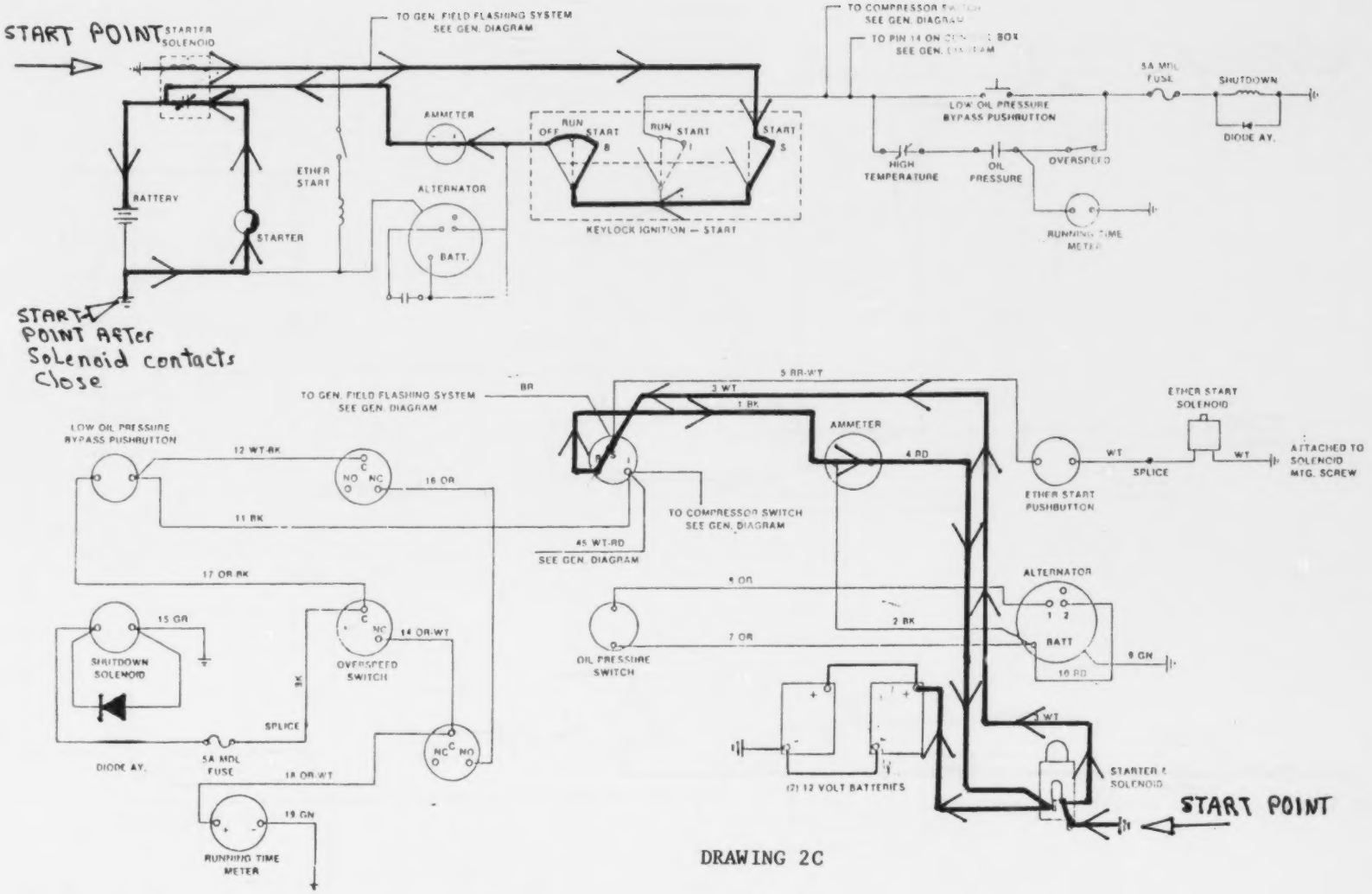
Select the CV multi connection and begin at the positive terminal to the power diode of CR1 to the physical connection. The stator windings are in a delta arrangement, that is T1 and T6 are connected T2 and T4, T3 and T5 are also connected. Continue through the stator winding T1 and T4 to the physical connection at CR1, pass through the power diode to the negative welding terminal. At this point go back to the stator and pick up the connection T6 and T3 and pass through those windings and then through the center power diode of CR1 to negative welding terminal. at this point go back to the stator to physical connection and go through coil group T5 and T2 following the game path as the first coil group T1, T4 did out of CR1 power diode to the negative welding terminal.

CV MODE



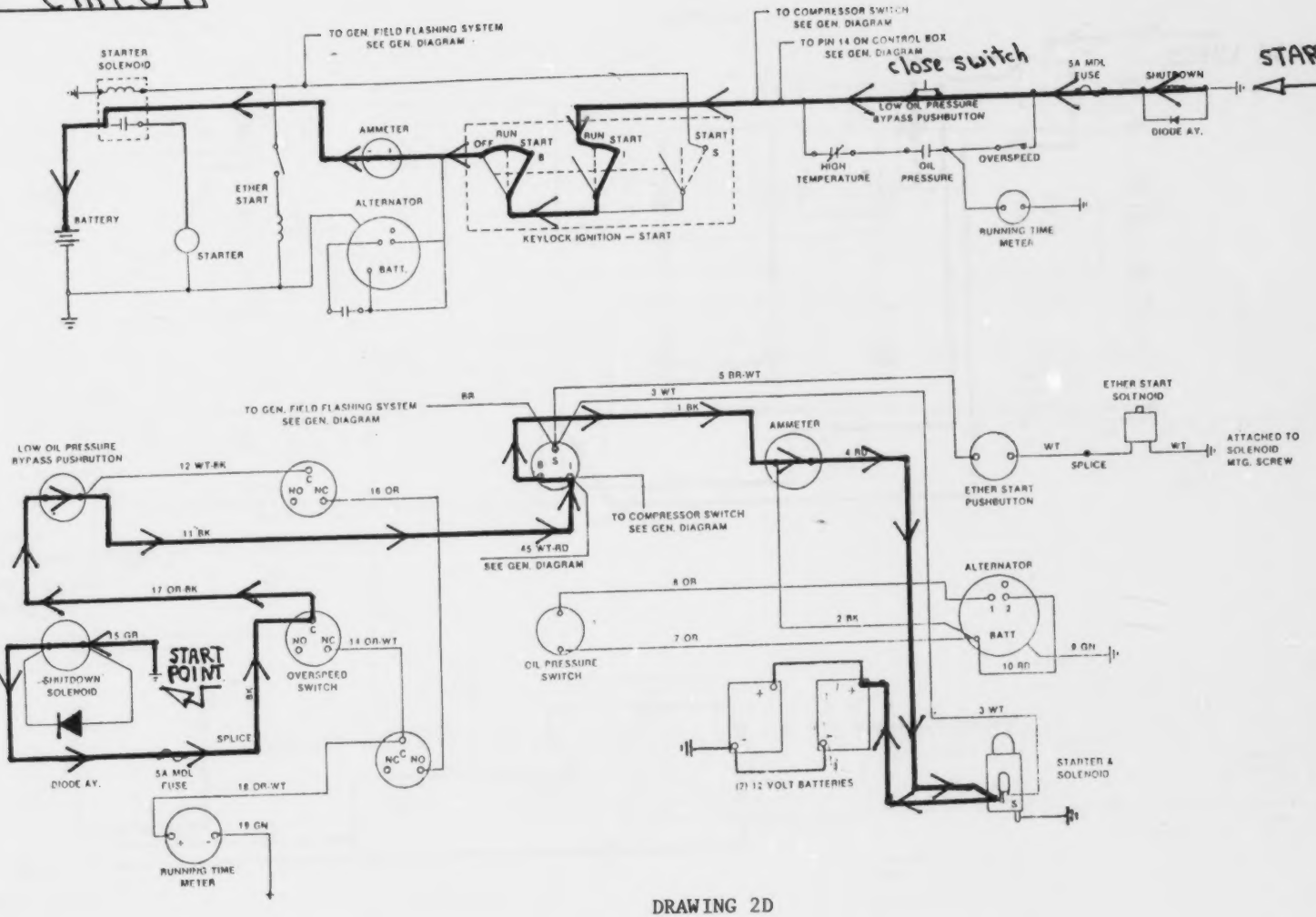
CURRENT WILL FLOW IN ONE PHASE AND OUT ON THE OTHER TWO PHASES

CRANK CIRCUIT



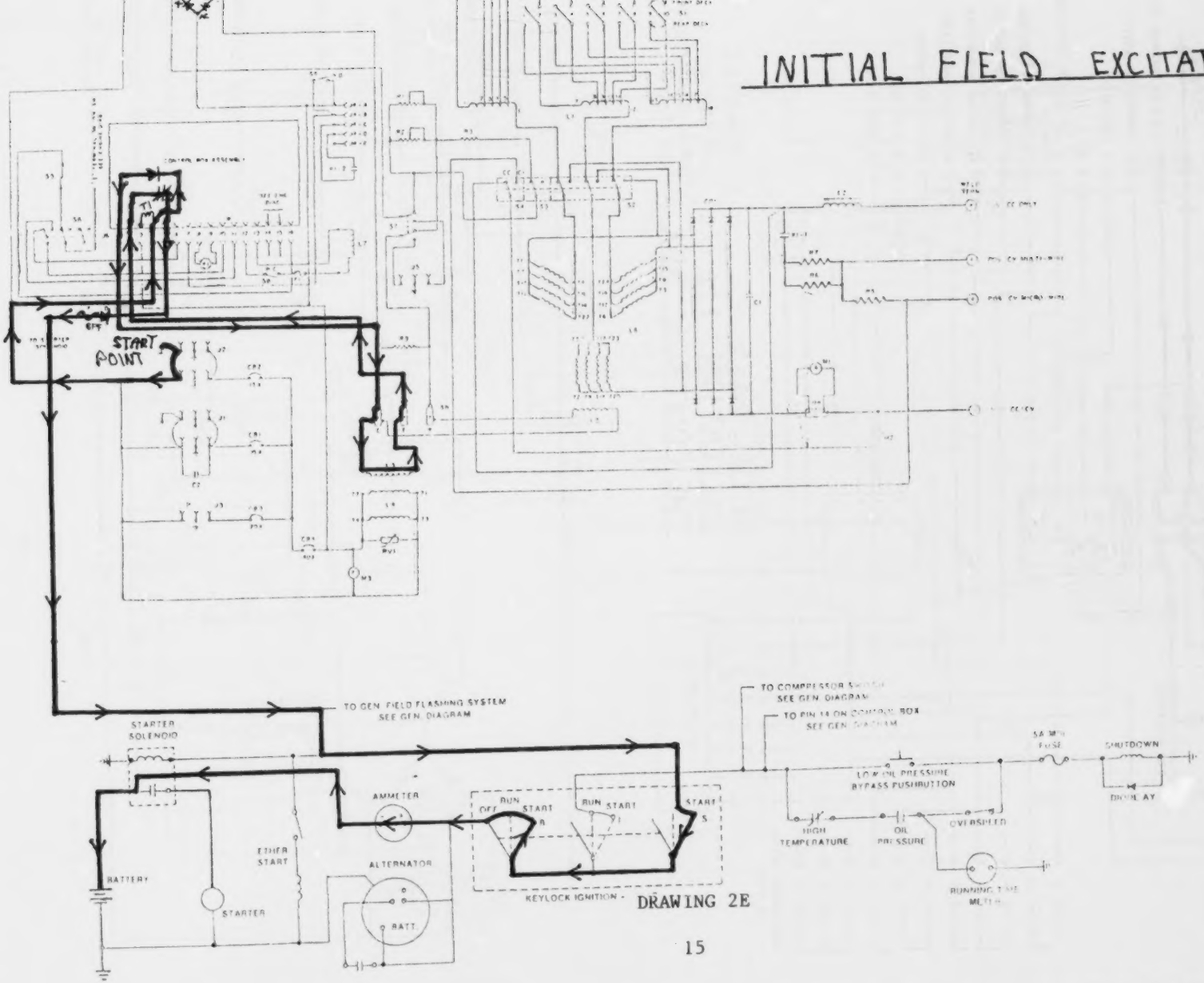
DRAWING 2C

START CIRCUIT

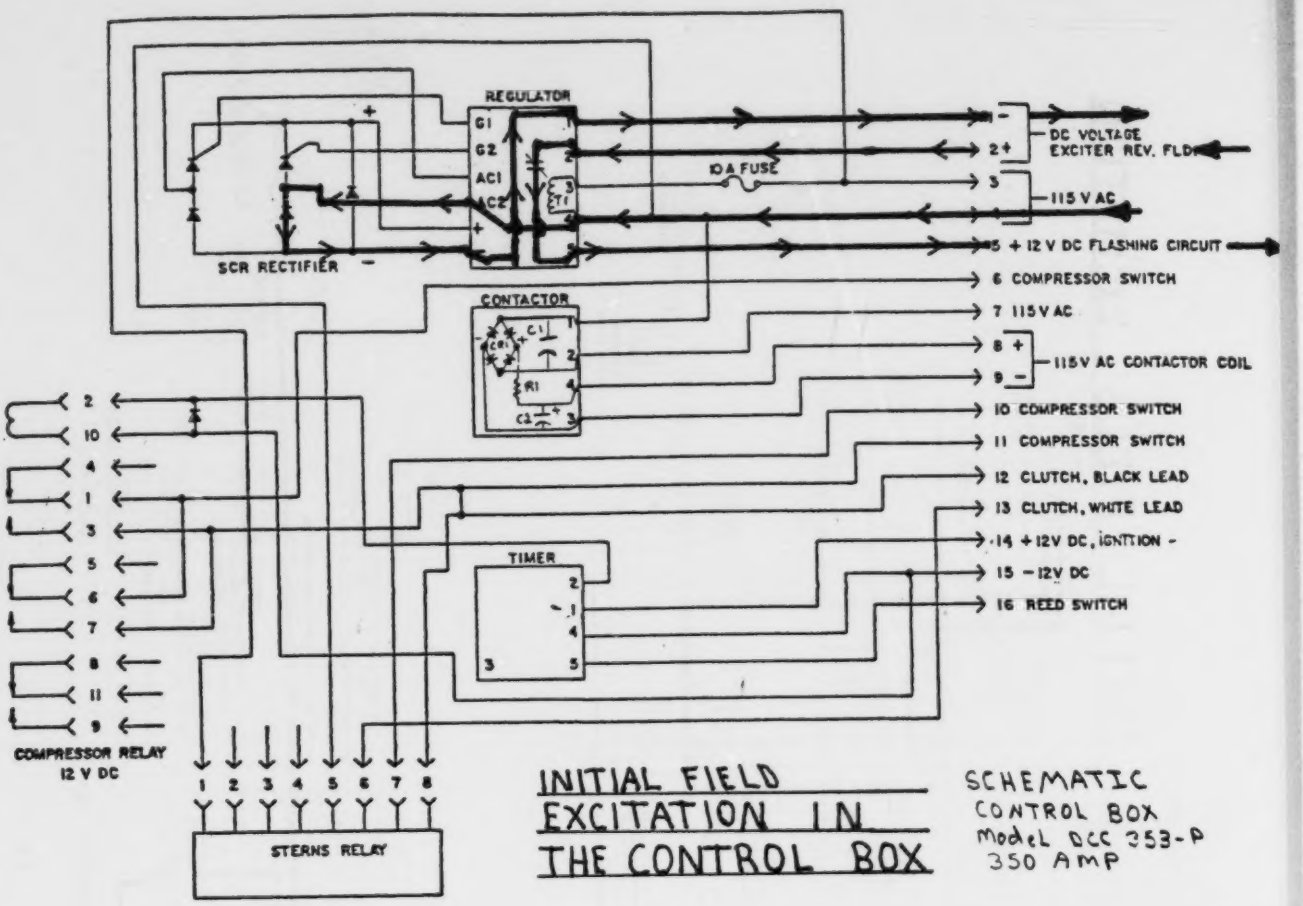


DRAWING 2D

INITIAL FIELD EXCITATION

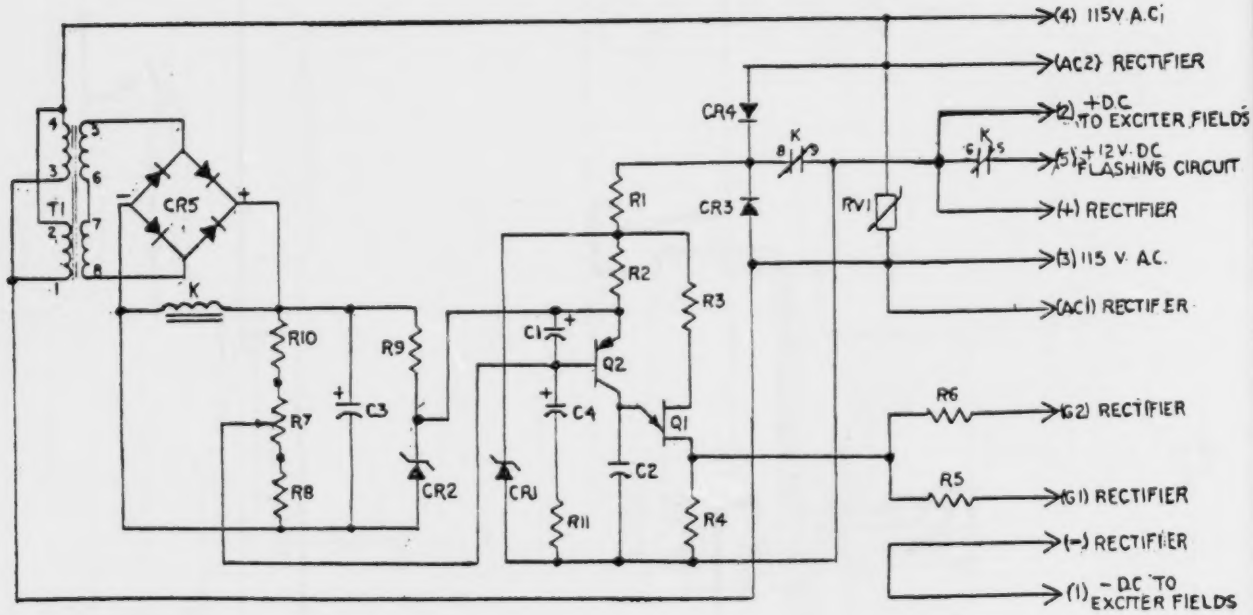


DRAWING 2E



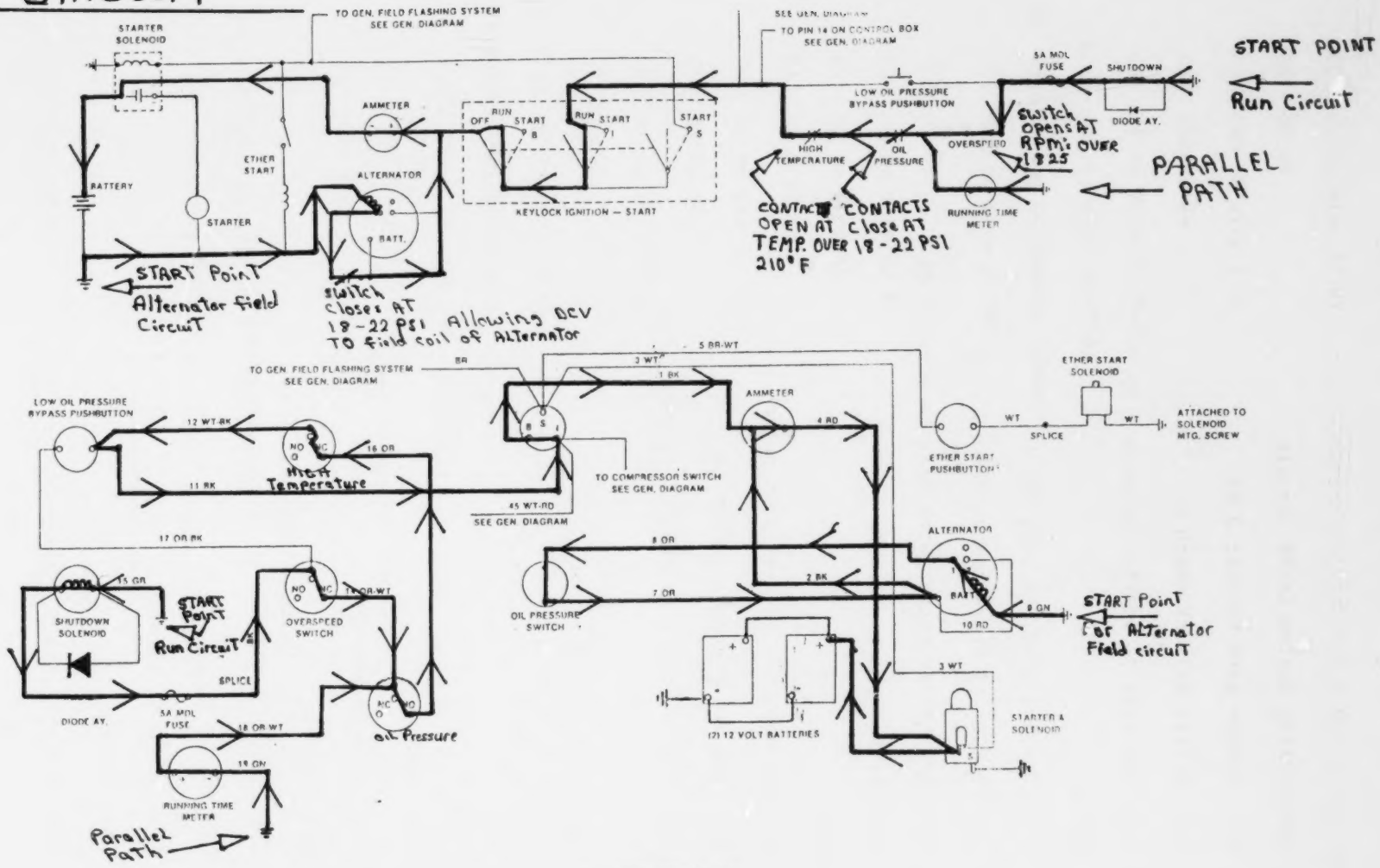
INITIAL FIELD EXCITATION IN THE CONTROL BOX

SCHEMATIC
CONTROL BOX
Model DCC 353-P
350 AMP



SCHEMATIC
VOLTAGE REG

RUN CIRCUIT



DRAWING 2F

Transposing and Diagnostic Maintenance

a. Transposing Engine Crank Circuit

(1) Common grnd to wire 3 WT

(2) S Term keylock swith to

(3) Neg term of ammeter to wire 4 RD

b. Start

(1) Commond grnd. to wire BK

(2) C Term of overspeed switch to wire

(3) Low oil pressure pushbutton to wire 11 BK

(4) Keylock lockswitch to

c. Run

(1) Common rnd. to overspeed switch

(2) Low oil pressure switch to

(3) Low oil press pushbutton to wire 11 BK

(4) Keylock switch to

d. Transposing Field Flash Circuit

(1) J2 to wire 1 WT-BK

(2) P6-4 to P6-1

(3) P6-1 to

(4) J6-2 to RD wire

(5) GFF to

e. Transposing Auxiliary AC Circuit (Halfwave)

(1) L4 to BK wire

(2) M3 to S2 BK wire

(3) CB4 to

(4) J6-4 to wire 1 WT-BK

(5) J1 to wire S1 WT

(6) M3 to

(7) CB4 to wire 7 BK

(8) CR2 to J4

(9) J4 to wire S4 BK-YL

(10) CR2 to wire 14 WT-RD

f. Transposing DC Control Circuit

(1) CR2 to wire 10 BR

(2) L5 to

(3) R9 to wire 13 YL

(4) S7 to wire 28 YL

(5) R1 & R2 to

(6) S7 to CR2

(7) R9 to CR2

(8) R2 to wire 17 YL

(9) R3 to

(10) S3 to wire 18 or

Diagnostic Maintenance

a. Field Flash Circuit Voltage Checks

(1) Keylock switch VDC _____

(2) GFF VDC _____

(3) _____

b. Auxiliary AC Circuit Voltage Checks

(1) CB4 and J1 VAC _____

(2) M3 VAC _____

(3) J4 VAC _____

(4) CR2 VAC _____

c. DC Control Circuit Voltage Checks

(1) CR2 VDC _____

(2) K1 VDC _____

(3) R9 VDC _____

1. Testing and Repairing Procedures

   a. Problem #1

   b. Problem #2

   c. Problem #3

   d. Problem #4

   e. Problem #5

SUPPLEMENTAL TRAINING MATERIAL

NOTE: The information contained herein was developed and prepared to aid in the repair of power generation equipment at DS/GS level of maintenance.

1. General

The Hobart design welder is capable of a DC output of 350 Amps and an AC output of approximately 26 Amps. This unique welder has an AC generator with three sliprings ounted on a single shaft and driven by diesel engine, operating at 1800 amps.

The AC portions of the welder will supply 3.2KW at 110 Volts; 60 Hz to the convenience receptacles to the voltage regulator (inside the control box) and the control rectifier for the necessary field excitation of the main welding generator.

The DC portions of the welder can be used as a constant current (CC) or a constant potential in the constant current position (ARC) it can be used to weld all types of steel with conventional electrodes/welding rodes. In the constant potential position it uses a MIG (Metal Insert Gas) gun to prevent oxidation and power-fed (motor driven) wire feeder for the filler metal. Over head welding can be performed by reversing the connections at the output terminals. It can be used for cutting steel by use of a carbon arc gouging torch with a side mounted air compressor.

2. Engine Circuit

The control devices of the crank, run, and stop circuit consist of starter solenoid, shutdown solenoid and five switches.

a. Normal Operation: Normal operation exists when the battery is capable of starting the engine and when the lubrication system is functioning properly (18-22 PSI) and when the battery charging system is indicating 10 amps positive and engine temp is between 195° to 210°F.

(1) Engine Starting

(a) Place the keylock switch in the "run" position. This switch controls the battery charging ammeter, oil pressure switch and 12 VDC to the starter motor.

(b) Hold the air pressure bypass switch in the closed position. This allows a complete circuit from ground of the shutdown solenoid, through the fuse, the now closed switch, through the keylock switch and back to the positive side of the batteries energizing the solenoid thereby moving the metering valve from its seat allowing fuel to enter the injection pump.

(c) Place the start switch in the start position. This completes a circuit from ground through the starter solenoid coil, closed keylock switch "B" to "S" terminals, through the battery charging ammeter and back to the batteries, energizing the starter solenoid and closing its contacts allowing the starter to crank the engine.

NOTE: The keylock switch must be released as soon as the engine starts to prevent damage to the starter motor.

(d) Hold the oil pressure by-pass switch in the closed position until engine oil pressure reaches 18-22 PSI. At this time the oil pressure switch will close a set of contacts allowing a complete circuit through a "safety" circuit, from the overspeed switch, oil pressure switch and the high temperature switch.

(e) In cold weather starting it may be necessary to use the ether start button to aid in the starting of the diesel engine. In this case, while cranking the engine (no more than 15 sec) push the ether start push button in. This closes the switch allowing a complete circuit from ground through the coil through the starter solenoid and back to the batteries, energizing the ether start solenoid thereby spraying ether through a line into the intake manifold of the diesel engine.

(2) Engine Running: Once the engine starts and the keylock switch is released to the run position, it opens the circuit to the starter solenoid deenergizing the solenoid and its contacts, and the starter will not turn. At the same time a parallel circuit is completed from grnd. Through the running time meter and shutdown solenoid, oil pressure switch, high temperature switch, low oil pressure bypass pushbutton keylock switch, ammeter and back to the batteries allowing the meter to register operating time of the welder.

(3) Engine Stopping: This is performed by unlocking the twist lock throttle and pushing it in allowing the engine to idle and then turning the keylock switch in the OFF position. This established an open circuit from ground of the shutdown solenoid and the positive side of the battery thereby denergizing the shutdown solenoid allowing the metering valve to reset, shutting off the fuel supply and stopping the engine.

(4) Safety Devices: The overspeed switch, oil pressure switches and the high temperature switch are the only protective devices on this engine.

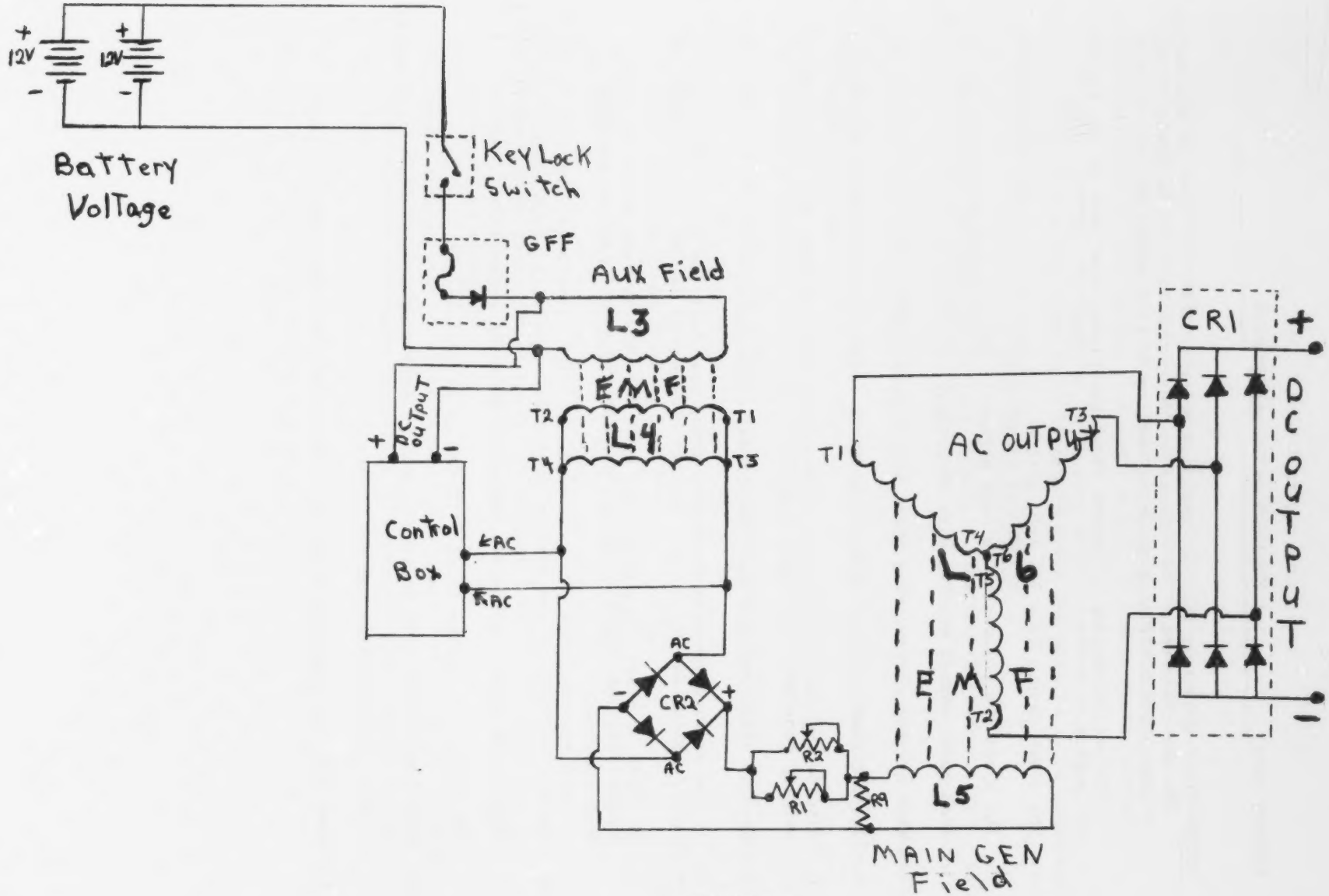
(a) When there is no oil pressure or there is a defective safety switch, the engine should not be operated.

(b) If the engine speed has exceeded 1840 RPMs, the overspeed switch may need to be reset by pushing in the reset button located on the switch.

3. Generator Circuits

a. AC Exciter Circuit (See Drawing 3A, Page 26)

(1) The initial excitation of Rev. Fields (L3) is provided by welder's storage batteries through circuitry, when the keylock switch switch is in the start position. Once the field of L3 has been flashed, a normally closed set of contacts within the control box will reverse opening the "Field Flash" circuit shutting off the supply f battery voltage to the revolving field. Field Flash, Relative Motion and the windings in the exciter stator (L4) are all that are required to produce an AC voltage. As the speed of the engine is increased the revolving field continues to build up utilities capable of producing 115 VAC. This 1Ø AC output is used to supply AC voltage to the voltage regulator within the control box, the convenience receptacles (through circuit breakers) and control rectifier (CR2). This regulated AC voltage input to CR2, is rectified to DC to provide the excitation (through circuitry and control reheostats) to the revolving fields (L5) of the main welding generator.


12V
12V
Battery
Voltage
Key Lock
Switch
GFF
Aux Field
L3
EMF
L4
T2
T1
T4
T3
DC output
+
-
Control
Box
AC
AC
AC
CR2
R2
R1
R3
L5
MAIN GEN
Field
T1
AC OUTPUT
T3
T4
T6
T5
L6
E
M
F
T2
CR1
+
DC OUTPUT
-

DRAWING 3A

STUDENT NAME_____ CLASS #_____

NOTE: These questions will be completed prior to the first hour of instruction in the classroom. The answers to these questions can be found in the supplemental training material section of this workbook.

*Before attempting to answer these questions, read Note at the top of page 1.

1. The power source is a 350 AMP, with a _____auxiliary power.
2. The hydrovane compressor is used primarily for _____.
3. This power source has how many slipring s?
4. What are two outputs this power source produces?
5. Initial excitation of exciter revolving fields is provided by what source?
6. Alternating current supplied to what component, is used for excitation of welding generator revolving fields.
7. Hw many safety devices does the diesel engine have?
8. If the engines speed exceeds 1840 RPMs, what must you do in order to start the engine.
9. In order to start the engine, you must turn the keylock switch to the on position and push the low oil pressure by-pass switch to energize what component.
10. How is the field in the welding generators revolving field controlled.
11. What is the normal operating temperature of the engine?
12. The electrical system is of a 12 VDC or 24 VDC design?
13. What item should only be used to aid in cold weather starting of the engine?
14. At what pressure does the oil pressure switch close?
15. What function does the shutdown solenoid have on the injection pump.

STUDENT PRACTICAL EXERCISE 1-1

Follow the steps below to remove the exciter stator assembly. Read through each step before you do anything. After you read the step, do exactly what it tells you to do. Use the TM references to locate parts and components if you are not sure where a part or component is located.

NOTE: During this exercise, if a wire or a connector is broken, use the wiring diagram to determine where the wire is to be connected.

DISASSEMBLY PROCEDURES

1. Disconnect the negative battery terminals from both batteries (12V). Refer to TM 9-3431-266-14&P, Pg. 3-40, Para 3-30 perform items 1 through 4.

2. Remove fuel tank. Refer to Pg. 3-13, Para 3-10 perform steps 7 through 12.

3. Remove lower control panel. Refer to pg. 3-71 + 3-72, Para 3-62 perform steps 1 through 6.

4. Tag and disconnect electrical leads from frequency meter.

5. Tag and disconnect electrical leads from the brush assembly. (Observe color code of the wires). (Refer to Pg. 3-73)

6. Remove metal shroud from around exciter stator. Refer to Pg. 3-74, Para 3-64. Perform steps 3 and 4.

   NOTE: Use caution when removing shroud from around electrical leads.

7. Remove bearing plate. Refer to Pg. 3-74, Para 3-64, perform Step 5.

8. Remove brush rack. Refer to Pg. 3-74, Para 3-64 perform Step 6. Use extreme caution when removing brush rack as not to damage any brushes and place on workbench.

9. Remove exciter stator. Refer to Pg. 3-74, Para 3-64, Step 7., Consult the instructor before removal. Place in guide pins and remove with caution as not to damage the stator windings and place stator on workbench.

10. Once you have completed the teardown procedures, stop your work and let the instructor know you are ready to perform PE 3-1 "Identifying Components on the Welder and Schematic Diagrams."

REASSEMBLY PROCEDURES

Follow the steps below to reinstall the exciter stator. Read through each step before you do anything. After you have read each step do exactly what it tells you to do.

1. Make certain the guide bolts are in place in the welding generator housing one on each side.

2. Lift exciter stator by hand or use a suitable lifting device to align stator housing on the guide bolts. (Make sure the two holes for mounting the brush holder assembly are to the top).

3. Once stator housing is in alignment, slide stator housing forward and reinstall the securing bolts. Once secured remove guide bolts.

4. Reinstall bearing plate. Refer to Pg. 3-75 Installation Step 4.

5. Remove lifting device if used.

6. Install brush assembly. Refer to PG. 3-75 Step 3. Make sure brushes are aligned and seated on the sliprings.

7. Observe color coding and reconnect wires to the brush terminals.

8. Reconnect wiring harness from the exciter stator.

9. Reinstall lower control panel. Refer to pages 3-72 & 3-73 Installation Step 1 through 6.

10. Reinstall fuel tank and secure with the mounting straps.

11. Reconnect fuel lines and turn on selector valve.

12. Reconnect the negative battery terminals.

13. Let the instructor know you are ready to test operate the welder.

(SEE TEST OPERATE)

TEST OPERATE

1. Follow the steps below to test operate the welder. Read through each step before you do anything. After you read the step do exactly what it tells you to do.

2. Use the TM and perform and before operation checks. Check engine oil level.

3. Ask the instructor to inspect the welder.

4. Install the welder output cables to the DC load bank and to the welder output terminals. Have the instructor to check your work. (Connect positive welding output cable to positive multi wire terminal.)

5. Place all the toggle switches on the load bank to the on position.

6. Place the mode switch on the welder to the constant voltage position.

7. Make sure the following switches and controls are set as listed below:

   a. Circuit Breaker: OFF

   b. Voltage Control: ZERO

   c. Compressor Switch: OFF

8. Turn to page 2-4, Section II in TM 9-3431-266-14&P. Follow the instructions in Section II and start the engine. Check for unusual noises or vibrations If you observe any unusual conditions shut the welder down immediately.

9. Push the circuit breaker toggle switch to the on position.

10. Push the CV contactor switch to the closed position.

11. Check that the load bank fan is operating. If it is not inform the instructor. If the fan is operating proceed this way:

    a. Rotate fine current control clockwise only, and watch the voltmeter and ammeter.

    b. Continue to rotate fine current control clockwise until voltmeter reads 25 volts and the ammeter reads 350 amps.

    c. Watch that both meter readings remain steady.

    d. Observe the arc welder for signs of unusual operation. Remove the load by opening circuit breakers and CV contactor switch and shut welder down to check for any unusual operation. (Refer to page 206, para 2-10, TM 9-3431-266-14&P for shutdown procedures.)

12. Record any signs of unusual operation on DA Form 2404 and inform instructor.

13. Disconnect load cables from the arc welder and place them on load bank platform.

STUDENT PRACTICAL EXERCISE 3-1

LESSON: Repair the 350 Amp Diesel Driven Arc Welder

OBJECTIVE:

ACTION: Locate components on the 350 Amp Arc Welder and schematic diagrams by doint the following:

1. Identify components of the 350 Amp Arc Welder.
2. Identify the components on schematic diagrams.
3. Observe location of components.

CONDITIONS: Given a 350 Amp Arc Welder, schematic diagrams, AC power supply 110 V droplight, and TM 9-3431-266-14&P.

STANDARD: The students will perform the above tasks to the following standards:

1. Identify components of the 350 Amp Arc Welder IAW 9-3431-266-14&P
2. Locate components on schematic diagram without error.
3. Observe location of components from memory.
4. Observe all safety precautions.

SUPPORT REQUIREMENTS:

1. REFERENCE: TM 9-3431-266-14&P

2 TRAINING AIDS:

a. 350 Amp Arc Welder (1 per 4 students)

b. TM 9-3431-266-14&P (1 per student)

3. STUDENT AND INSTRUCTOR MATERIALS, SUPPLIES AND EQUIPMENT:

a. Instructor: Instructor Notes

b. Student:

(1) Pencil and Paper

(2) Schematic Diagram of 350 Amp Welder

(3) Wiring Diagram 350 Amp Welder

TRAINING AREA:

1. INDOOR: Training laboratory equipped with one arc welder, work table, and TM 9-3431-266-14&P for each group of 4 students.

2. OUTDOOR: None

TRANSPORTATION REQUIREMENTS: None

ADDITIONAL PERSONNEL AND DEMONSTRATON TROOPS:

1. Assistant Instructors: One per group of four students.

2. Demonstration Troops: None

ADMINISTRATIVE INSTRUCTIONS:

1. Prior to the class beginning the instructor will insure each station is set up and ready for the practical exercise.

2. The instructor will insure that one assistant instructor per each group of four students is present in the training laboratory.

INSTRUCTIONS:

During this practical exercise you will locate the components of the 350 Amp Arc Welder. You will identify each component, tell where it is located on the equipment and explain its purpose. You will be required to find the components on the equipment and locate it on the schematic diagram. Follow the instructions carefully and if you have any questions, ask one of the instructors for assistance.

IDENTIFY COMPONENTS

During this practical exercise you will locate the components of the 350 Amp Arc Welder. You will identify each component on the welder and schematic diagrams, and explain their purpose to the instructor. You will be required to find the components on the equipment and locate it on the schematic diagram. follow these instructions carefully and if you have any questions ask one of the instructors for assistance. Once you have completed PE 3-1 perform PE 3-2.

LEAD THROUGH PRACTICAL EXERCISE 3-2

LESSON: Repair the 350 Amp Diesel Driven Arc Welder

OBJECTIVE:

ACTION: Learn the operations and diagnostic testing procedures of the 350 Amp Arc Welder assemblies by doing the following.

1. Reading the description of operation and studying the schematic diagrams.
2. Inspect the exciter stator assembly.
3. Testing components of exciter stator assembly.
4. Observe all safety precautions.

CONDITIONS: Given a 350 Amp Arc Welder, DA Form 2404 General Mechanics Toolbox, Multimeter DT360, Megometer, Internal Growler, AC Power Supply 110V droplight, Hydraulic Lifting Device, Tags, Masking Tape, TM 9-3431-266-14&P.

STANDARDS: The student will perform the above tasks to the following standards:

1. Read the theory of operation IAW TM 9-3431-266-14&P.
2. Identify all visual and electrical faults and record on DA Form 2404.
3. Follow all test procedures IAW TM 9-3431-266-14&P.
4. Observe all safety precautions.
5. Test operate the Arc Welder under load, according to specifications.

SUPPORT REQUIREMENTS:

1. REFERENCE: TM 9-3431-266-14&P
2. TRAINING AIDS:

a.	Megometer	(1 per 4 students)
b.	Multimeter TS 352 B/U	(1 per 4 students)
c.	Multimeter DT 360	(1 per 4 students)
d.	Internal Growler	(1 per 4 students)
e.	DA Form 2404	(1 per station)
f.	Power Supply 110 VAC	(1 per station)
g.	Extension Cords	(As required)

3. STUDENT AND INSTRUCTOR MATERIALS, SUPPLIES AND EQUIPMENT:

a. Instructor: Practical Exercise Guide

b. Student: Practical Exercise Instruction Booklet

TRAINING AREA:

1. INDOOR: Training laboratory equipped with one arc welder, work table and general mechanics tool box for each group of four students.

2. OUTDOOR: None

TRANSPORTATION REQUIREMENTS: None

ADDITIONAL PERSONNEL AND DEMONSTRATON TROOPS:

1. Assistant Instructors: One per group of 4 students.

2. Demonstration Troops: None

ADMINISTRATIVE INSTRUCTIONS:

1. Prior to the class the instructor will place the practical exercise instruction booklet, TM's, DA Form 2404, and general mechanics tool box at each work station.

2. The instructor will insure that one assistant instructor per each four students is present inthe training laboratory.

3. The instructor with the aid of his assistant instructors will conduct a 100% inventory of the general mechanics tool boxes.

INSTRUCTIONS:

During this practical exercise you will begin learning the operation of the 350 Amp Arc Welder. As the practical exercise progresses you will inspect, test and record faults found during the exercise. Follow each part of the instruction carefully and if you neeed clarification of any material covered, ask the instructor for assistance.

PRACTICAL EXERCISE 3-2

1. During this practical exercise you will first learn the operation of the 350 Amp Arc Welder exciter stator assembly, main welding generator assembly, rotor assembly and power rectifier assembly. Once you have reviewed the operation instructions you will test each component using the diagnostic equipment provided.

2. Read the operation of the 350 Amp Arc Welder below and ask the instructor to explain any points that are unclear to you.

a. Before you inspect the exciter stator assembly, study your generator schematic diagrams and then read the description of operations listed below.

b. The exciter revolving field, L-3 (mounted on a single axis shaft) obtains its excitation from the storage batteries once the welder's engine is started.

c. Once the engine is running and the revolving field excited, AC voltage is then induced in the exciter stator windings. The output from the stator windings is delivered through wires to the auxiliary power receptacles on the control panel, to the voltage regulator inside the control box assembly, power for the contactor control and to the bridge rectifier CR2 for the excitation of the welding generator.

d. Look at the generator schematic diagram and locate the generator revolving fields L-5. Notice the generator exciter is connected in series with the exciter L-3. Both revolving fields L-3 and L-5 are excited at the same time and are both controlled by the voltage regulator inside the control box assembly. By controlling the amount of excitation controls the output in the stator windings of L4 and L6.

e. Notice the L-6 on your generator schematic diagram contains many coils. These coils are compound wound windings, 3 phase, wye connected to give highAC amperage output.

f. The AC amperage produced by the welding generator is transmitted through a mode switch S-2, to a control reactor and a range switch, giving a coarse adjustment of welding current in the constant current mode only. Amperage is transferred back to the mode switch through the diodes of the power rectifier (CR1) where the AC amperage is rectified to DC amperage and transmitted through a stablizing reactor, to produce a low ripple DC current used in shielded metal arc welding.

g. In the constant voltage mode, the AC amperage produced by the welding generator is transferred to a two position mode switch. By selecting the CV position, a connection is made within the mode switch which transfers the amperage directly to the power rectifier by passing the control reactor (L1) and the range switch (S1) the DC amperage once

rectified by the power diodes CR1 pass through high amperage cables to a load contactor K1. This contactor is controlled by the toggle switch on the control panel and once closed, simultaneously closes the contactor, allowing DC amperage to pass through various ballast resistors, depending on the welding terminal used, and transmitted to the welder output terminals labeled Pos CV Multi Wire or Positive Micro Wire.

h. The constant voltage output is controlled by the voltage regualtor within the control box assembly controlling the amount of excitation being applied to the revolving fields of L-5.

i. In both modes constant current and constant voltage, an ammeter is connected in series with a shunt, registers the amount of DC amperage being produced by the welding generator.

j. The voltmeter connected in parallel, registers the voltage produced.

k. Look at your schematic diagram again and locate the bridge rectifier CR2. DC voltage from this rectifier is applied through the rheostat control circuit (R1 and R2) to the three phase welding generator revolving fields. By varying the resistance in R1 and R2 controls the field of the generator revolving fields.

l. The control box assembly is solely the heart of the welding machine, consisting of an integrated voltage regulator, a contactor, timer and relays. These components are truly the brains of this unit and controls all functions of the welder. Minor repair is limited such as replacing fuses, relays and wires.

3. Perform the following checks on the 350 Amp Arc Welder:

a. Inspect the exciter stator housing. Record all faults on DA Form 2404. Look for cracks, damaged mounting holes, excessive wear of the bearing retainer plate and capscrews. Check pole shoes for uneven werar, signs of burning cracked insulation and other damage. In the field all faulty components and parts must be replaced. For training purposes you need only to identify and record all faults.

b. Test the exciter stator field resistance. Measure between the two leads on the exciter housing. A reading of .25-.28 ohms is a good reading. Record your reading below and any faults on DA Form 2404.

Exciter Stator Field Resistance_____ohms.

c. Check the exciter field for grounds. Set your multimeter on RX 10,000 ohms. Check from each lead to the frame. A reading of infinity shows that there are no ground faults. Record all faults on DA Form 2404.

d. Test the exciter field coils for short circuits. Plug in the internal growler and test for correct operation. Before using growler make sure that all wires from the windings are clear and are not touching any metal parts.

e. Turn on the growler. Touch the side of the growler RED side down to the various segments in the housing. Hold the growler over a segment for five seconds. The turn OFF the growler and touch the segment area with your hand. Signs of short circuits in the field coils that can be identified when using the internal growler are as follows:

(1) Vibration or clacking sound from growler.

(2) Heated segment area.

(3) Arcing between the coil windings.

f. Test the remaining segments as you did in the last step until all areas are covered within the exciter housing. Look for the three signs of short circuit listed above. Record all faults on DA Form 2404.

g. To test for insulation breakdown in the coil a megometer must be used. Read the instructions on the face of the megometer carefully and connect the "megger" test leads to the electrical leads of the exciter housing. Operate megger handle and observe meter reading. A minimum of one megohm is a good reading. Record your reading below and any faults on DA Form 2404.

Megometer Reading _____

h. Now inspect the sliprings and exciter windings located on the rotor assembly. Look for signs of broken insulation and wires. Check that the sliprings are clean and smooth. Check the prelubricated bearing It should rotate freely with no grinding.

i. To test the exciter windings L3 and L5, measure resistance between the collector rings. Then check between the collector rings and armature shaft. Record your reading in the space provided.

- Ring to + Ring _____ L3
- Ring to + Ring _____ L5
Ring to Shaft _____
Ring to Shaft _____
Ring to Shaft _____

There should be conintuity between the rings and infinity between ring and shaft. Record any faults on DA Form 2404.

j. Tag and disconnect power cables from diodes of power rectifier. Test each power diode with multimeter. A reading of high resistance in one direction and low resistance in the other indicates a good reading. Record your reading below any faults on DA Form 2404.

Positive Diodes	Negative Diodes
1._____	1._____
2._____	2._____
3._____	3._____

k. Inspect contactor K1. Check for burnt contacts and broken wires on contactor. Test contactor K1 with multimeter. Test contactor coil for resistance and opens. A good coil will have a resistance reading. Check for continuity across contacts of K1. If you have continuity when contacts are closded the reading is good. Record your readings below.

Coil Reading	_____	Ohms
Contacts	_____	Continuity

Let the instructor know you are ready to perform Practical Exercise 3-3.

LEAD THROUGH PRACTICAL EXERCISE 3-3

LESSON: Repair the 350 Amp Diesel Driven Arc Welder

OBJECTIVE:

ACTION: Perform slipring maintenance by doing the following:

1. Visually inspecting the sliprings.
2. Clean the sliprings with strips of 00 sandpaper.
3. Record faults on DA Form 2404.

CONDITION: Given a 350 Amp Arc Welder, general mechanics toolbox, strips of 00 sandpaper, AC power supply droplight and TM 9-3431-266-14&P.

STANDARD: The student will perform the above tasks to the following standards:

1. Visually inspect sliprings IAW 9-3431-266-14&P.
2. Clean all sliprings without damage.
3. Record all faults on DA Form 2404.
4. Observe all safety precautions.

TIME: 1 Hour

SUPPORT REQUIREMENTS:

1. REFERENCE: TM 9-3431-226-14&P, Welding Machine

2. TRAINING AIDS:

a.	350 Amp Arc Welder	(1 per 4 students)
b.	Double 00 Sandpaper	(As required)
c.	DA Form 2404	(1 per station)

3. STUDENT AND INSTRUCTOR MATERIALS, SUPPLIES AND EQUIPMENT:

a. Instructor: Practical Exercise Guide

b. Student: Practical Exercise Instruction Booklet

TRAINING AREA:

1. INDOOR: Training area equipped with one arc welder, worktable, and general mechanics toolbox for each group of four students.

2. OUTDOOR: None

TRANSPORTATION REQUIREMENTS: None

ADDITIONAL PERSONNEL AND DEMONSTRATON TROOPS:

1. Assistant Instructors: One per group of 4 students.

2. Demonstration Troops: None

ADMINISTRATIVE INSTRUCTIONS:

1. Prior to the class beginning the instructor will place the practical exercise instruction booklet, double 00 sandpaper, DA Form 2404 at each station.

2. The instructor will insure that there is one assistant instructor per each four students present inthe training laboratory.

3. At the beginning of the class the instructor will demonstrate proper procedue in cleaning the sliprings.

INSTRUCTIONS:

During this Practical Exercise you will inspect and clean the sliprings of the 350 Amp Arc Welder. Follow the instructions in the practical exercise guide carefully and have the instructor clear up any questions.

LEAD THROUGH PRACTICAL EXERCISE 3-3

Inspecting and Cleaning the Sliprings

1. The instructor will show you the proper way to clean the sliprings.

2. Inspection:

   a. Check the sliprings for looseness, flat spots, streaks and grooves.

   b. Check for pitting caused by arcing brushes.

3. Cleaning:

   a. Using strips of 00 sandpaper, clean the sliprings with light pressure on surface of sliprings.

   b. The sliprings are made of brass and only require minor cleaning.

   c. The surface of the sliprings should be smooth and shiny.

   d. Deep grooves and pitting would require the resurfacing of the slip-rings on a lathe.

4. Record any faults found on DA Form 2404.

5. Have the instructor check your work once youhave completed your inspection and cleaning procedures.

6. Let the instructor know you are ready to perform practical exercise 3-4. Follow the instructions in Student Practical Exercise.

LEAD THROUGH PRACTICAL EXERCISE 3-4

LESSON: Repair the 350 Amp Diesel Driven Arc Welder

OBJECTIVE:

ACTION: Perform brush maintenance of the 350 Amp Diesel Driven Arc Welder.

1. Removing brushes from brush holder.
2. Inspecting each brush for uneven wear.
3. Checking for broken, cracked or chipped brushes.
4. Checking for continuity between brush and the electrical lead attached to the brush.
5. Rsurfacing the brushes.
6. Replace all faulty brushes with new.
7. Cleaning of the sliprings.

CONDITIONS: Given a 350 Amp Arc Welder, General Mechanics toolbox, Multimeter DT360 00 Sandpaper, Spare Brushes, AC Power Supply 100V, droplight and TM 9-3431-266-14&P.

STANDARD: The student will perform the above tasks to the following standards.

1. Remove brushes from holder without damage.
2. Identify all visual and electrical faults.
3. Follow all procedures.
4. Replace faulty parts with new.
5. Assemble brushes in brush holder without damage.
6. Observe all safety precautions.

TIME: 1 Hour

SUPPORT REQUIREMENTS:

1. REFERENCE: TM 9-3431-266-14&P, Welding Machine

2. TRAINING AIDS:

   a. 350 Amp Arc Welder
   b. Double 00 Sandpaper
   c. Spare Brushes

3. STUDENT AND INSTRUCTOR MATERIALS, SUPPLIES AND EQUIPMENT:

   a. Instructor: Practical Exercise Guide

   b. Student: Practical Exercise Booklet

TRAINING AREA:

1. INDOOR: Training laboratory equipped with one arc welder, work table, and general mechanics tool box for each group of four students.

2. OUTDOOR: None

TRANSPORTATION REQUIREMENTS: None

ADDITIONAL PERSONNEL AND DEMONSTRATION TROOPS:

1. Assistant Instructors: One per group of four students.

2. Demonstration Troops: None

ADMINISTRATIVE INSTRUCTIONS:

1. Prior to the beginning of the class the instructor will insure there is adequate double 00 sandpaper and spare brushes available for the practical exercise.

2. The instructor will insure that one assistant instructor per each four students is present in the training laboratory.

3. At the beginning of the class the instructor will demonstrate to the students the proper way to inspect, resurface the brushes.

LEAD THROUGH PRACTICAL EXERCISE 3-4

Brush Maintenance

1. The instructor will demonstrate how to remove, inspect, and resurface brushes.

2. Make a visual inspection of brushes and brush holder.

   a. Check each brush for uneven wear. (Every 3 months)

   b. Check for broken, cracked or chipped brushes and brush holder.

   c. Check for continuity between brush and electrical lead attached to the brush with multimeter.

   d. Replace brushes that are worn to 7/16 of an inch and that are defective.

   e. Check brush holder assembly for broken terminals.

3. Resurfacing: Resurface all brushes that have uneven wear the way the instructor demonstrated to you using 00 sandpaper to the contour of the sliprings.

4. Assemble brushes in holder.

   a. Install each brush in brush holder assembly being careful not to damage them.

   b. Install brass cap.

   c. Check that all brushes are moving freely in the guide.

   d. Have the instructor check your work when you have completed it.

   e. Let the instructor know you are ready to perform Student Practical Exercise 1-1, Reinstall Exciter Stator.

SOURCE MATERIALS

LESSON: Repair the 350 Amp Diesel Driven Arc Welder

1. TM 9-3431-266-14&P	Welding Machine
2. Manufacturer Manual	Hobard New Equipment Training Welding Shop

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